21 $x = 2\sin t$, $y = \cos 2t$ highest point $1.5 \le t \le 4.5$

$\frac{dy}{dt} = -2\sin 2t = 0$

$2t = 0, \frac{\pi}{2}, \frac{2\pi}{2}, \frac{3\pi}{2}$

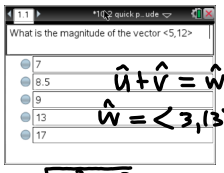
$t = 0, \frac{\pi}{2}, \pi$

$t=0$ $x=0$ $y=1$

$t=\pi$ $x=0$ $y=1$

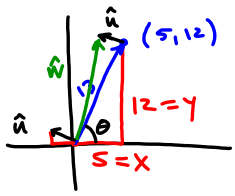
Feb 8-9:25 AM

10.2 Vectors $\hat{u} = \langle -2,1 \rangle$ $\hat{v} = \langle 5,12 \rangle$ or $(13 \angle 1.17)$ $\langle x,y \rangle$ $(r \angle \theta)$



$\hat{u} + \hat{v} = \hat{w}$

$\hat{w} = \langle 3,13 \rangle$



$r = \sqrt{x^2+y^2}$

$\theta = \tan^{-1}\left(\frac{y}{x}\right)$

$x = r\cos\theta$

$y = r\sin\theta$

mag $|\hat{v}| = 13 = r$

direction $\theta = \tan^{-1}\frac{12}{5} = 1.17$ or $67.38°$

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Vector valued functions speed $= |\hat{v}(t)|$

A particle moves in the plane so that its position at any time t>=0 is given by (sin t, $t^2/2$).

(a) Find the position vector $= \hat{r}(t) = \left(\sin t, \frac{t^2}{2}\right)$

(b) Find the velocity vector

(c) Find the acceleration vector

(d) Determine the path of the particle

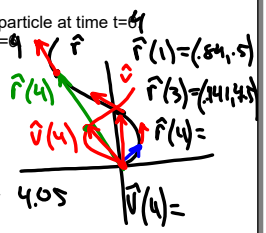
(e) Describe the position and motion of the particle at time t=

(f) Find the velocity and the speed at time t=

(b) $\hat{v}(t) = (\cos t, t)$

$\hat{v}(4) = \langle -.65, 4 \rangle$

speed$(4) = \sqrt{(-.65)^2+4^2} = 4.05$



(c) $\hat{a}(t) = (-\sin t, 1)$

Feb 20-6:06 PM

Displacement and Distance Traveled

A particle moves in the plane with velocity vector v(t) = (t-3πcos πt, 2t-πsin πt).

At t=0 the particle is at the point (1,5)

$\hat{v}(t) = \left(\frac{dx}{dt}, \frac{dy}{dt}\right)$

(a) Find the position of the particle at t=4.

(b) What is the total distance traveled by the particle from t=0 to t=4?

(a) $\hat{r}(t) = \left(\frac{t^2}{2} - 3\sin\pi t + c_1,\ t^2 + \cos\pi t + c_2\right)$

$1 = 0 - 3\sin 0 + c_1$ $\quad 1 = c_1$

$5 = 0^2 + \cos 0 + c_2$ $\quad c_2 = 4$

$\hat{r}(4) = \left(\frac{4^2}{2} - 3\sin 4\pi + 1,\ 4^2 + \cos 4\pi + 4\right)$

$\hat{r}(4) = (9, 21)$

(b) $\int_a^b \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2}\, dt$ = arc length = distance

speed

$\int_0^4 \sqrt{(t-3\pi\cos(\pi t))^2 + (2t-\pi\sin(\pi t))^2}\, dt$

33.5327

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